Power Sources

Operator Manual

Service Manual

711 UNIVERSAL DESK CHARGER

Welch Allyn Medical Division
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Skaneateles Falls, NY 13153-0220

711380 Rev. C

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Drawings and/or illustrations and/or part numbers contained in this document are for reference purposes only. For current revisions call the Welch Allyn Customer Service phone number listed in Section 1 page 3.

Contents

PAGE

Section 1: General Information
1.1 About the Universal Desk Charger 1
1.2 Block Diagram 1
1.3 Hardware Electrical Specifications 2
1.4 Help Information 3
1.5 Product Number Structure 3
1.6 Safety Warnings 4
1.7 Approvals 4

Section 2: Service
2.1 Incoming Inspection/Checklist 5
2.2 Required Tools 5
2.3 Incoming Operational Test 5

Section 3: Troubleshooting
3.1 Functional Tests/ Initial Diagnostic Steps 6

Section 4: Repair and Disassembly
4.1.1 Base Housing Removal/Installation 7
4.1.2 Printed Circuit Board Replacement 7
4.1.3 Fuse Replacement 8

Appendix A: Theory of Operation 9

Appendix B: Assembly Drawing 13

Appendix C: Electrical Schematic 14

1.1 About the 711 Universal Charger

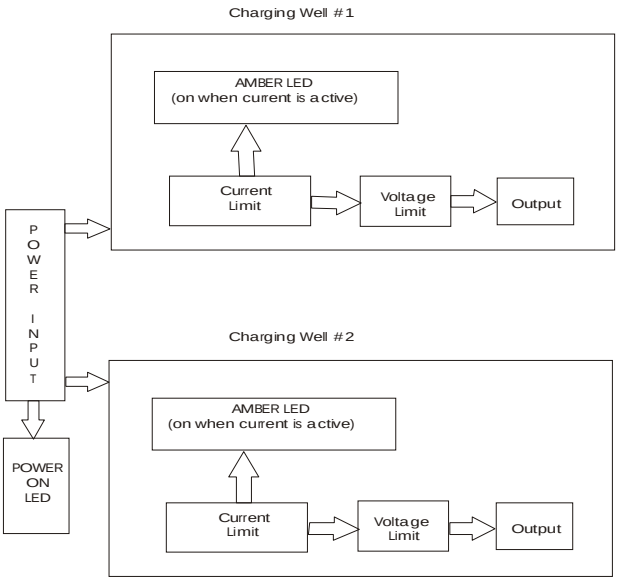
The universal desk charger electrical circuitry is designed to provide a safe (if not optimal) trickle charge profile for all Welch Allyn handles. It is intended to replace the 71110 Desk Charger. However, the major improvements over the 71110 that directly affect the electrical design are:

1. It is intended to operate from an AC power source from 100V to 275V. Along with a standard IEC connector, this will be an international unit. Performance tests show that the charger will operate down to 90V with a single handle receiving a full charge rate (65 mA), and two handles receiving >45 mA. This exceeds our present 71110 handle which provides 20 – 30 mA under the same conditions.

2. It is intentionally designed to charge handle / battery combinations that range from 2.5V to 5.5V end-of-charge voltages. Given the present high / low line and high / low battery voltage combinations, the 71110 charger varies its charge current from 20 mA to 80 mA. The universal desk charger is designed to vary by less than 10% under these conditions (typically less than 2%).

3. The universal desk charger provides charge indicator LED's as well as power on indicator LED(s).

1.2 Block Diagram



1.3 Hardware Electrical Specifications

1.3.1 Absolute Maximum Ratings

IInput Voltage Range:	100VACRMS to 240VACRMS, 50Hz or 60HZ.
Peak Input Voltage:	275VACRMS (limited by LM317T max voltage spec and transformer design) It is only guaranteed to maintain SELF internal voltages up to 240V, which is its highest rated input.
Output Voltage:	0V – Open Circuit Voltage (Output may be dragged below zero volts if input voltage is less than the peak input voltage)
Output Current:	0 mA to +100 mA (internally limited to 80 mA for short circuit)
Operating Temperature:	5 - 35 Degrees Celsius *, 10% - 90% Relative Humidity Storage Temperature: -20 - +50 Degrees Celsius *, 10% - 90% Relative Humidity

* This may not be a suitable range for the batteries under charge.

1.3.2 Operating Conditions

Output Voltage:	<10VDC (no load)
Current Limit:	55 mA to 80 mA
Power Consumption (No Load):	7W Max (high line transformer losses, no load)
Power Consumption (Full Load):	10W Max (high line PCB resistor, transistor, LED, and LM317 at max Load)
Power Dissipation:	Internally Limited to 17W (Assumes full transformer loss at dual short circuit)

1.4 Help Information

All service and repairs must be performed by fully trained and properly equipped personnel, using genuine replacement parts and correct procedures. Failure to do so will invalidate the 1 year new product product warranty.

Customer Service
Welch Allyn, Inc.
4341 State Street Road, PO Box 220
Skaneatles Falls, NY 13153-0220 U.S.A.
Telephone 1-800-535-6663
When calling, refer to the model number on the bottom of the Universal Charger.

The Model Number is the first three digits of the Serial number number found on the bottom of the Universal Charger.
Troubleshooting assistance is contained in Section 3 of this manual to help determine which board is malfunctioning. This manual does not support repairing the printed circuit boards.
Year 2000 Information: The Universal Charger is Y2K compliant and will not encounter "Year 2000" problem

1.5 Product Model Number Structure

71140	US, Canada, Japan Version
71142	European Version
71144	United Kingdom Version
71146	Australian Version

1.6 Safety Warnings

Read and understand all safety warnings and service notes printed in this Service Manual and the Operator's Manual part number 711137.

Use hospital grade plugs only.

Green power light indicates that main power is connected to the appliance.

Only authorized Welch Allyn Service Centers can perform service.

This product complies with current required standards for electromagnetic interference and should not present problems to other equipment nor is it affected by other devices. As a precaution, avoid using this device in close proximity to other equipment.

See User Manual or call Welch Allyn for the most current approvals.

1.7 Approvals

C ETL LISTED US 74227 UL 2601-1, CAN/CSA C22.2 No 601.1, IEC 60601-1, IEC 60601-1-2

N344 EMC Framework of Australia

CE The CE mark on this product indicates that it has been tested to and conforms with the provisions noted within the 93/42/EEC Medical Device Directive.

Authorized European Representative Address:
European Regulatory Manager
Welch Allyn Ltd.,
Kells Road, Navan,
County Meath, Republic of Ireland.
Tel.: 353-46-79060 / Fax: 353-46-27128

2.1 Incoming Inspection

2.1.1 Inspect shipping package and product for damage. Make a record of possible shipping damage.

2.2 Required Tools

2.2.1 Tools required for service: Phillips screw driver, repair test handle T17814.

> ***NOTE:*** *Any Welch Allyn rechargable handle can be substituted for the T17814 repair test handle*.

2.2.2 The repair test handle, Tool# T17814, can be ordered from Welch Allyn by calling Customer Service at 800-535-6663.

2.3 Incoming Opertional Test

2.1.1 Apply main power to the unit and ensure that the green LED light illuminates.

With main power applied, insert any Welch Allyn nicad handle into one of the charging wells and ensure that the amber charge LED under that well lights. Repeat the test on the opposite charging well.

3.1 Trouble Shooting

3.1.1 Green LED not on.

Use a known good power cord. Replace the power cord if this fixes the problem.

Check Fuses
If fuses are OK then replace printed circuit board.

3.1.2 Amber charge LED not on.

Insert a Welch Allyn rechargeable handle in charging well or T17814 repair test handle. If the amber charge light still does not come on, then replace printed circuit board.

4.1 Repair and Disassembly

Observe all ESD precautions

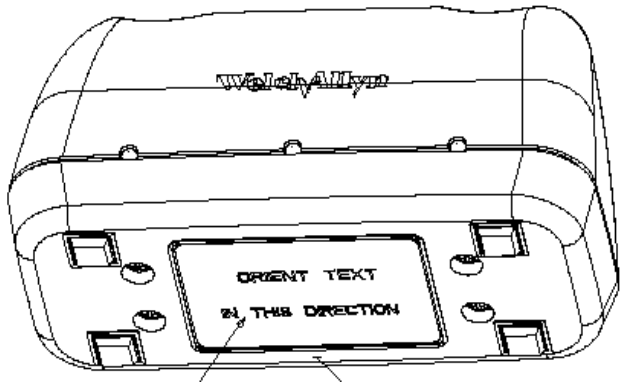
Observe all ESD Precaution

4.1.1 Base Housing Removal/Installation

Removal

Remove the 4 screws holding the base housing to the cover housing.

If a new base housing is required: Clean the label and foot recesses on the new base housing with isopropyl alcohol and allow them to dry. Install a new model label in its recess as shown below.



Install 4 new feet in their corresponding recesses
Stamp the new base housing with the original date of manufacture.

Installation

Place the base housing on top of the PCB (printed circuit board) with the LED and IEC recesses lined up with their respective components.

4.1.2 Printed circuit board replacement:

Remove base housing as described above.
Carefully lift printed circuit board up and out of the cover housing.
Carefully place the new PCB into the cover housing. Make sure the contacts are lined up with their respective slots in the cover housing.

Make sure LEDs and IEC connectors are lined up with their respective slots in the cover housing.

Reinstall base housing as described above.

OBSERVE ALL ESD PRECAUTIONS

4.1.3 Fuse Replacement:

Remove base housing as described above.
Remove PCB as described above.
Pry the two fuses out of the brackets on the IEC connector that is attached to the PCB.
Insert the new fuses into the brackets on the IEC connector.
Reinstall the PCB as described above.
Reinstall the base housing as described as above.

Detailed Description Theory

Input

The **Input** provides a power entry module, transformer, bridge rectifier, and sufficient bulk capacitance to assure 200 mA operation under low line conditions.

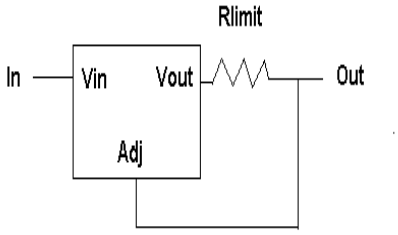
The full wave bridge consists of four 1N4004 rectifier diodes.

The bulk filter capacitor is 1000 uF, 50V. Since the rectified voltage cannot exceed 40V (LM317 limitation), and the transformer cannot exceed 25VACRMS (per agency) the design has a safe margin. Given the expected 200 mA constant current load, the droop in 10 mS (50 Hz, full wave rectified) should be 2V per half cycle.

Current Limit

The **Current Limit** limits the output current to 65 mA typical.

The current limit circuitry in its most basic form employs a LM317 adjustable voltage regulator and a current viewing resistor. The resistor is placed between the adjust pin and the output pin. The input to the current source is the Vin pin. The output is at the adjust pin end of the viewing resistor as shown:



By design, a voltage regulator will shut down its output current as the voltage between the output and the adjust pin approaches regulator's set voltage. (In the case of the LM317, the set voltage is nominally 1.25V.) This condition gets satisfied when the output current approaches 1.25V/Rlimit. Therefore, simply picking the correct resistor value can choose any desired current .

In the actual circuit, there is another resistor between The Output and Adj. This is necessary for proper operation of the voltage limit circuit, which will be discussed below. However, it should be noted here that this resistor will have essentially no effect on the operation of the basic current limit circuitry as described, since the current out of the Adj pin is very low.

Transformer Headroom - The maximum trip point (shutdown voltage) of the Simba handle is 5.06V. The current limit circuit requires a maximum of 1.3V (across the sense resistor) + the LM317 dropout voltage (1.6V @ 200 mA). This requires 7.36V DC to guarantee 200 mA operation. Depending upon the performance of the transformer, charging may take a bit longer at low line. The low line tests have determined that the charger will perform to nominal charge down to 100V input. At 90V, a single handle will charge at its full rate, while two handles will charge at about 45 mA each .

Voltage Limit

The **Voltage Limit** limits the output voltage to <8.78V. The requirement is 9.5V in order to keep from biasing the input protection Zener diode in the Simba Handle.

On its own, the simplified current limit circuit described above will provide constant current from short circuit until the LM317 runs out of headroom. This is great for charging the NiCad's. However, the Simba handle eventually shuts down its charge when the battery is fully charged. There is a 10V 1/2W input protection Zener diode on the Simba handle, designed to protect the internal circuitry from over voltage at the end of charge.

As mentioned in the discussion of the current limit circuit, the LM317 adjustable regulator will shut down the output current as the voltage between the output and the adjust pin approaches 1.25V. The voltage limit circuitry employs a 6.8V Zener diode connected to the adjust pin on the LM317. This Zener limits the adjust pin to 6.8V , which in turn prevents the output from nominally exceeding 6.8V +1.25V. As mentioned in the discussion of the current limit circuit, there is a resistor between the adjust pin and the current limit output. This limits the current through the Zener diode when the circuit is in Voltage limit mode.

Zener diode when the circuit is in Voltage limit mode.

LED

The **LED** section detects the current limit condition to indicate that a charge is in process. This requires one Yellow LED per charge well. There is also a green LED's that simply indicate that power is on.

Green Power On Indicator LED

The green LED is powered from a constant current source.

The constant current source uses three PNP transistors, two pass transistors (required to handle worst case power) and one sense transistor. The sense transistor limits the current by robbing the pass transistors of their base bias. The sense transistor has its emitter connected to +VRAW. There is a resistor between the emitter and base of the sense transistor that provides a path for the LED current. Whenever the LED current exceeds approximately 0.65V / Rsense, the sense transistor turns on. The collector of the sense transistor is tied to the bases of the pass transistors, which are normally pulled to ground (to turn on the pass transistors). Hence, whenever the pass transistor begins to turn on, the current is limited.

The pass transistors each have a 20 ohm resistor in series with their base to avoid current "hogging" by one of the pass transistors should the pass transistor be mismatched. These resistors typically drop only .13V .

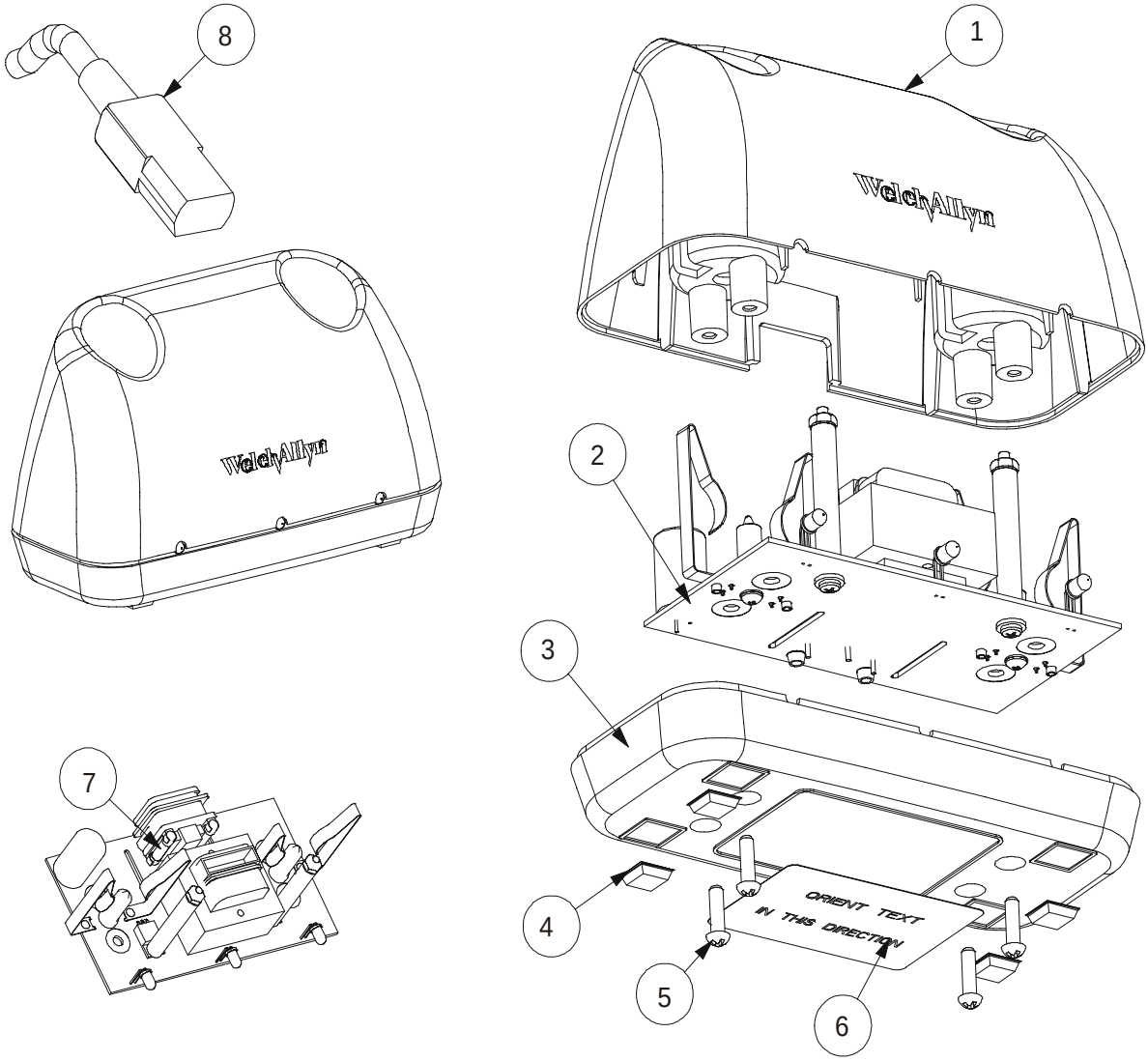
Some of the older handles (still in the field) have no charge polarity diodes installed. Since the LM317T's used in the charging circuit are not reverse bias protected, the green "power on" LED's will be powered by one of these batteries, when the AC power is disconnected. This could confuse someone to think that their charger is connected to an AC source when it is not. Therefore, there are two diodes connected between the base of the pass transistors (diode cathodes), with each anode connected to one of the charging wells positive contacts. In this manner, should either battery voltage ever exceed the raw DC voltage, the corresponding diode will forward conduct, and the pass transistor will not be biased (and the green "power on" LED's will be shut off).

Yellow Charge indicator LEDs

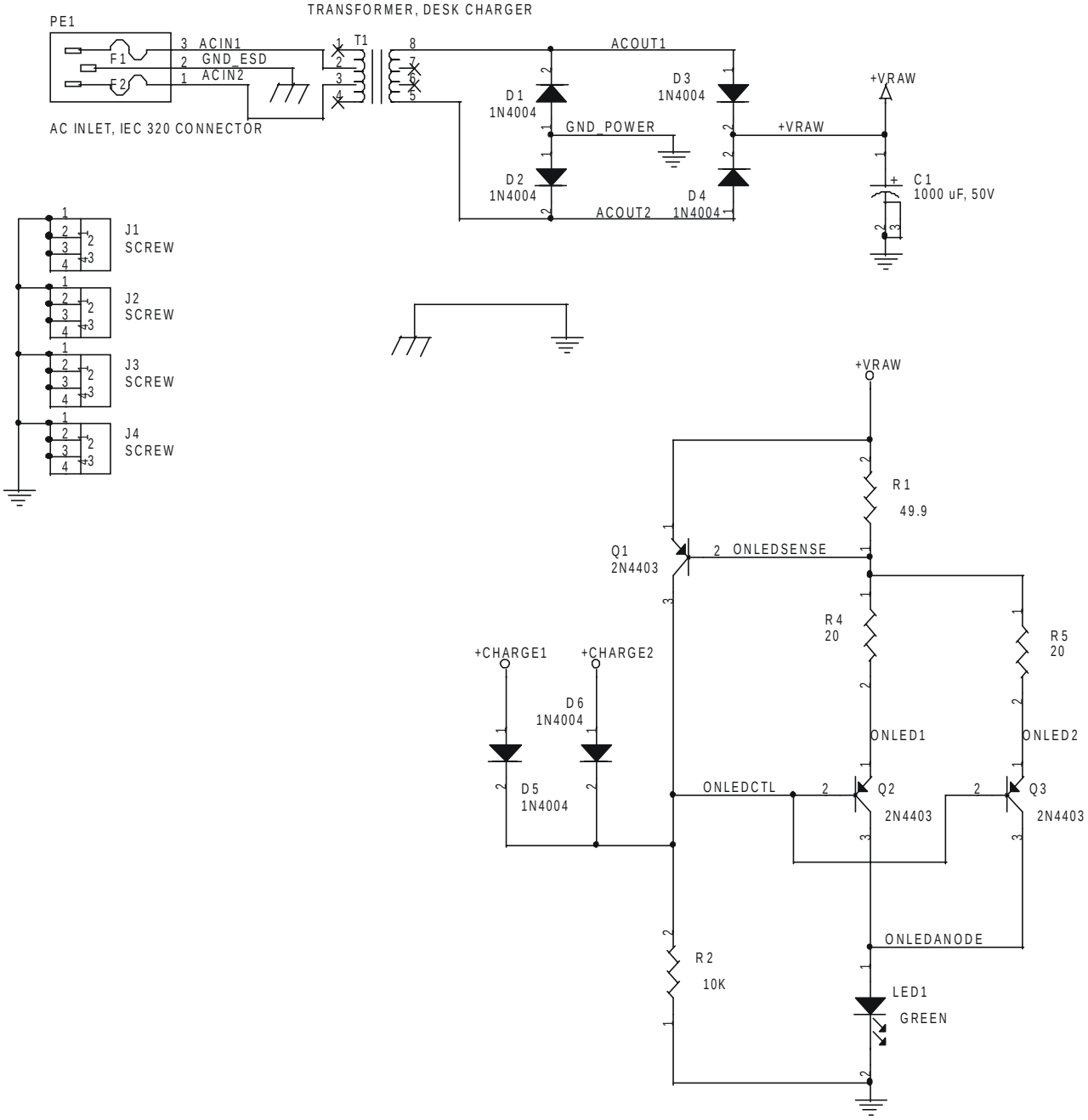
Each yellow LED is meant to show that a particular well is charging.

The yellow LED is on when the current limit is active. To do this, the base – emitter junction of a PNP transistor is placed across the battery charger current limit sense resistor. Whenever the voltage drop across the current limit sense resistor exceeds .6V, the transistor is turned on, and power is supplied to the LED. Coincidentally, .6V is roughly ½ of the LM317 adjust voltage (1.25V). Therefore, the LED starts conducting current when the battery charge current is around ½ the current limit value. However, the LED becomes viewable at a somewhat higher charge current.

Since the yellow LED receives its power on the high side of the battery charger sense resistor, the LED current does not affect the current limit to the battery.



Ref	Part Number	Description 71141
1	711101-1	COVER, DESK CHARGER, PRINTED
2	711096-502	PC BOARD ASSY
3	711104	BASE, DESK CHARGER
4	495083	RUBBER FEET
5	711074	MDL LABEL,711 SERIES,DESK CHGR
6	106124-48	SCREW,#8 PLASTITE,.625L,PH
7	236706-3107	FUSE- INTERNATIONAL
8	761076-0	POWER CORD, DETACH.(DOM/JAPAN)
8	761076-2	POWER CORD-DETACH (EUROPEAN)
8	761076-4	POWER CORD-DETCHBL (U.K)
8	761076-6	POWER CORD DETACH (AUSTRALIA)



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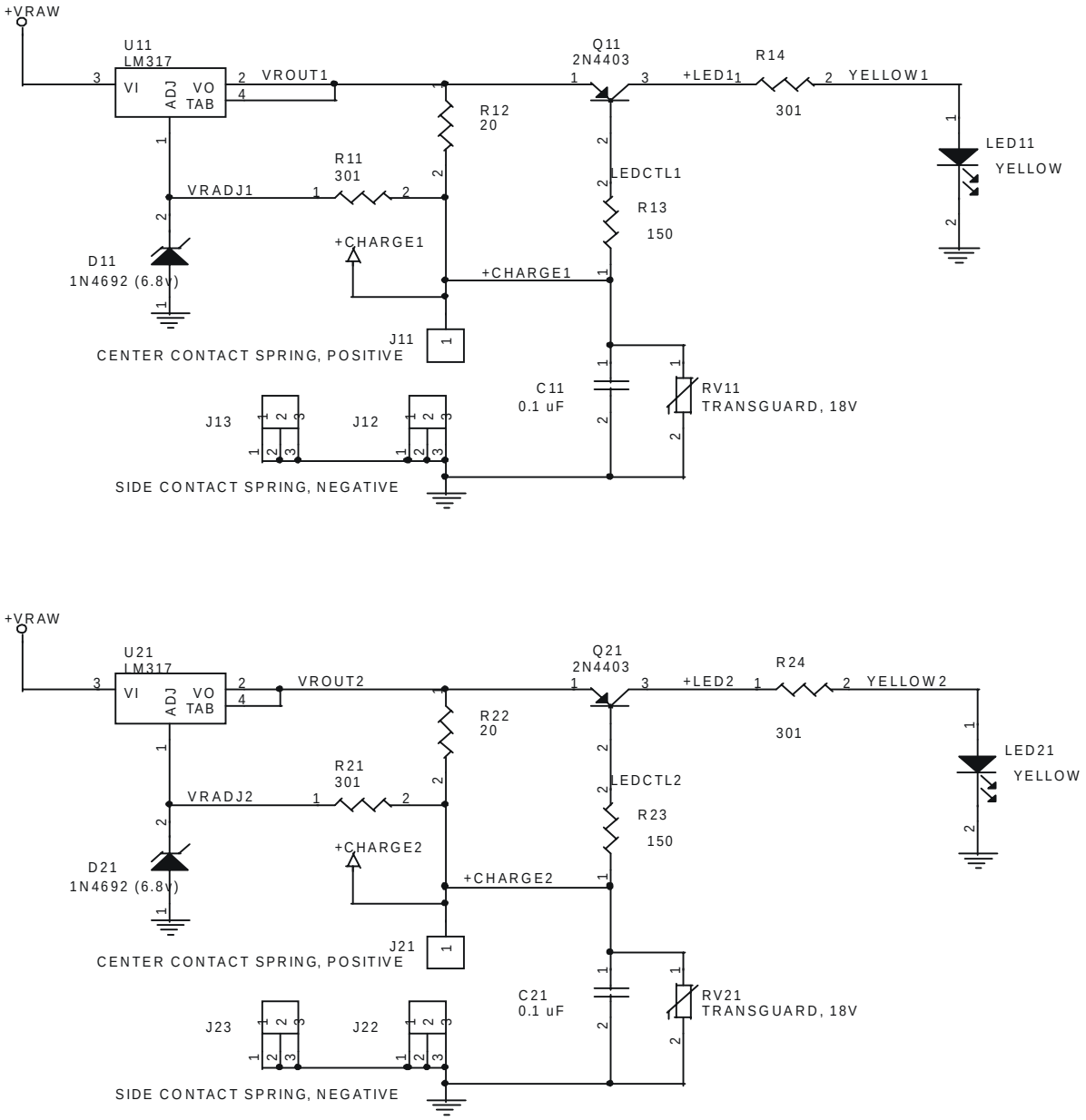

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